

Work Plan
WMA Mini-Grant Research Project
Humboldt WMA State Coastal Conservancy
January 1, 2011-December 31, 2011

Contract Lead Group and Contact Person(s):

Lead Group: State Coastal Conservancy

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Project Lead(s) for project and contract reporting and invoicing: (name, phone number, email, and address):

As above

This project is in affiliation with what WMA group or groups?

Humboldt WMA (Humboldt Harbor, Recreation and Conservation District)

List what other Noxious and Invasive Weed Research has been conducted by you or your group:

Effect of *Spartina densiflora* eradication on benthic invertebrates in Humboldt Bay salt marshes

Effects of imazapyr treatment on *Spartina alterniflora* in San Francisco Bay (with Invasive Spartina Project)

Proposed Project(s)

Project Title: Control of *Spartina densiflora* with Mechanical and Chemical Methods in Muted and Unmuted Tidal Marsh

Project Goal (1/2 page max)

The goal of this project is to help determine the most effective control method for non-native dense-flowered cordgrass (*Spartina densiflora*) in the Humboldt Bay region, and to restore native vegetation in its place. This research project will compare control efficacy and native revegetation using three control methods: 1) mowing, 2) chemical (imazapyr), and 3) mowing followed by chemical application to resprouts. Efficacy of chemical application depends partly on drying time (hours between application and tidal inundation). Therefore, this research project will utilize sites in muted and unmuted tidal marsh in order to examine the effect of this variable on treatment efficacy. This research project will inform the development of a regional invasive cordgrass eradication plan for the Humboldt Bay, Eel River, and Mad River estuaries. The goal of the plan is to restore and protect the native plant and wildlife communities of tidal marshes in these three estuaries. Invasive dense-flowered cordgrass has invaded an estimated 90% of salt marshes in the three adjacent estuaries of Humboldt Bay, the Eel River Delta, and the Mad River Estuary. *S.densiflora* is known to displace native vegetation, reducing the biodiversity of the salt marsh dramatically. The species was mapped in Humboldt Bay in 1998 and 1999. At that time, over half of the total salt marsh consisted of nearly pure stands of invasive cordgrass, and the species was present in much of the remaining salt marsh, as well. While invasive cordgrass is most abundant at mid-marsh elevations in Humboldt Bay, it has been shown to be spreading to the high marsh, where it threatens to displace populations of Humboldt Bay Owl's Clover (*Castilleja ambigua* ssp. *humboldtensis*) and Point Reyes Bird's Beak (*Cordylanthus maritimus* ssp. *palustris*), both ranked as endangered (List 1B.2) by the California Native Plant Society. Whereas *S. densiflora* is the only species of *Spartina* currently known in Humboldt County, other west coast estuaries that have been studied and/or managed have been invaded primarily by *S. alterniflora*. This species occupies a very different ecological niche and its role and impacts in the estuary cannot be generalized to *S. densiflora*.

What are the project's long-term benefits and/or local, regional or statewide significance (8 sentence Max):

The project will inform the development of a Regional *Spartina* Eradication Plan by helping to identify the ecological role and environmental impacts of *S.densiflora*. The project will facilitate the restoration of native vegetation in Humboldt Bay, Eel River and Mad River Estuary, plant and wildlife habitat of regional and statewide importance for resident and migratory species. In addition, the project will facilitate the protection of marshes in Oregon and Washington from colonization by invasive *Spartina* seeds dispersing from the Humboldt Bay region. In addition to its direct impacts, the dominance of invasive cordgrass in Humboldt Bay has slowed efforts at marsh restoration because of fears that restored marshes will become dominated by cordgrass, compromising their habitat value. The 2007 West Coast Governors' Agreement on Ocean Health Draft Action Plan calls for the west coast-wide eradication of invasive *Spartina* cordgrasses.

Priority Topic Area Being Addressed (from request for proposal announcement, 8 sentence Max):

This proposal addresses Priority #2: Little to No Management Research Conducted to Date. While abundant research has been conducted on the management of other invasive *Spartina* species, especially *S. alterniflora*, little research has been conducted on *S.densiflora*, especially examining the efficacy of chemical control. The USFWS Humboldt Bay National

Wildlife Refuge has conducted research on digging and mowing to control this species, but has not examined chemical methods. The San Francisco Invasive Spartina Project has found through treatment experience that imazapyr is less effective on *S. densiflora* than *S. alterniflora*. However, no systematic research on the effectiveness of imazapyr alone or in combination with other methods under different tidal conditions has been conducted.

Please Describe your in-kind contributions toward research project(s) (4 sentence max):

In-kind contributions will include Conservancy project manager/biologist staff time to manage the project, collect, analyze, and present the data.

Project Objectives, Tasks and Methods

OVERALL OBJECTIVE (4 sentence Max):

This study aims to determine the efficacy of three *S. densiflora* control methods in muted vs. unmuted tidal marsh. The three control methods studied will be: 1) application of imazapyr alone, 2) mowing alone, 3) mowing followed by application of imazapyr to resprouts. In addition to examining the efficacy of these methods at controlling *S. densiflora*, recolonization by native vegetation will be studied.

Task 1 (2 sentence Max): Baseline surveys of study sites

Methods (8 sentence Max)-

Establish nine 15 m by 15 m treatment areas and three control areas each in one unmuted tidal marsh site and one muted site. Establish 30 permanent 0.25 m² plots within each treatment area, located along five 15 m long transects extending across the treatment areas at 2.5 m intervals. Total cover and cover by species of all vascular plants, by bare ground, and by wrack will be visually estimated in each plot using a gridded quadrat (subdivided into 25 sections). • Stem height of live and dead stems of non-native Spartina will also be measured. Live and dead stems of non-native Spartina will be counted. Life history stage of Spartina shoots will be recorded (vegetative, flowering, senescent).

Task 2 (2 sentence Max): Implement initial and follow-up treatments.

Methods (8 sentence Max)-

Treatments will be applied to the treatment area, as well as a 1.5 m buffer on each side. The total time required to treat each of the treatment areas will be recorded. Mowing will be done by a single, experienced mower for consistency, as will chemical application. Initial treatment will be in June. Chemical treatments will be conducted as close to low tide as possible, in order to maximize dry time. Follow-up treatments will be as follows: 1) Mowing: mowing of resprouts and seedlings will be conducted three months following initial treatment, as well as every three months thereafter, 2) Chemical-Follow-up spray treatment will be conducted one year after initial treatment. 3) Combined method: Resprouts will be sprayed once they have attained large enough size to be able to absorb the herbicide.

Task 3 (2 sentence Max): Measurement of treatment efficacy

Methods (8 sentence Max)-

Data will be collected as in Task 1.

Performance Measures

How will you assess and/or analyze your results (8 sentence Max)?

The study will test the following hypotheses:

1. Mowing, application of imazapyr, mowing together with imazapyr application and no treatment do not differ in their effect on cover class of non-native Spartina, reduction in the number of live stems of non-native Spartina, and in cover class of native vascular plants.
2. The treatment methods above do not differ in their effects on non-native Spartina cover class or live stem counts, or in their effects on native vascular plant cover, when used in muted vs. unmuted tidal marsh sites.

Factorial ANOVA will be used to test the above hypotheses.

How will your results be disseminated (4 sentence Max)?

Results will be presented orally and in writing to the San Francisco Invasive Spartina Project, the West Coast Invasive Spartina Group, and to the California Invasive Plants Council. Study results will be incorporated into the Humboldt Bay Regional Invasive Spartina Eradication Plan, and into the California Non-Native Spartina Early Detection and Rapid Response Plan.